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ES&H STANDARD OPERATING PROCEDURE

Title: **CLASS 3B AND CLASS 4 LASER SYSTEMS OPERATIONS IN RESEARCH (U)**

Location: SNL Laboratories and Facilities

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CLASS 3b AND CLASS 4 LASER SYSTEMS OPERATIONS IN RESEARCH

1.0 PURPOSE, SCOPE, AND OWNERSHIP

1.1 Purpose

This ES&H SOP is intended to provide the foundation for the safe use of Class 3B and Class 4 Laser Systems in support of research and development within Division 1000 as well as other divisions of Sandia National Laboratories, which agree to comply with the conditions of this ES&H SOP. This ES&H SOP or a Technical Work Document is required by the ES&H Manual, Chapter 6G.

1.2 Scope

This document applies to the use of Class 3B and Class 4 laser systems in research applications within SNL and at other national test sites involving SNL personnel. It is intended that this SOP be applied in conjunction with a **site-specific Operating Procedure (OP)** which shall be prepared for each laboratory, facility, or project, which contain Class 3B or Class 4 laser system(s) or operation(s). The OP shall detail specific controls and procedures for the safe use of those laser systems or laser operations. The **site specific OP** shall be **reviewed annually** for currency by the document owner. Class 4 laser systems having a continuous power level exceeding 500 Watts or pulse energies in excess of 100 Joules per pulse may be more appropriately covered by a separate Activity Specific ES&H SOP as determined during the development, review and approval process. A template and instructions for the preparation of a **site-specific OP** is given in Appendix B. Instructions for writing Operating Procedures (OP) are governed by SNL Document GN470001. The format for writing OPs should be consistent with this document.

1.3 Document Ownership

Department 1128 is responsible for this document. Any recommendations for improving this document should be forwarded to the author, Department 1128, MS 1423.

2.0 RESPONSIBILITIES

2.1 Individual responsibilities and authorities are defined within the SNL ES&H Manual, chapter 6G.

2.2 The laboratory owner shall be responsible for development, distribution, revision and control of the **site-specific OP.**

2.3 The Deputy Laser Safety Officer (DLSO) shall assist in the development of the OP. In addition, the DLSO shall serve as the independent technical reviewer of the site-specific OP.

2.4 The owning Department Manager shall approve the site-specific OP.

2.5 A copy of this ES&H SOP and the corresponding site-specific OP shall be posted or maintained in a binder or on-line by the laboratory, facility or project owner where laser workers have ready access to it.

2.5 The Qualified Laser Operator shall read, understand and abide by both the ES&H SOP and the site-specific OP, and certify the above by signing the OP.

2.6 The Qualified Laser Operator shall inform Authorized Personnel of site-specific hazards (HAZCOM) before they are permitted to work in the controlled access area.

2.7 The Qualified Laser Operator shall inform Incidental Personnel of site-specific hazards before they are admitted to the controlled access area.

3.0 TRAINING QUALIFICATIONS

3.1 Training and Requirements

Minimum training will be in accordance with the SNL ES&H Manual, Chapter 6G-Training, to include LAB100 and ENV112 (where there is a hazardous or chemical waste associated with the laser operation).

Minimum training for maintenance involving hazardous voltages will be in accordance with SNL Electrical Safety Program. Generally ELC106- R&D Electrical Safety (> 50 volts) is appropriate.

3.1.1 General requirements for Qualified Laser Operator:

Baseline Laser Eye Examination

Sandia approved Laser Safety Course (training in the safe use of lasers as outlined by **ANSI Std. Z136.1-2007**). Generally LAS202 and LAS200SPEC (Site Specific Training) are required for Class 3B & 4 laser operations (see ES&H Manual Chapter 6G-Training).

Knowledge of the manufacturer's operating instructions.

Obtain the Owning Manager's approval and authorization to perform laser operations.

Site-specific Training

3.1.2 General requirements for Incidental Personnel:

Eye Examination for visual acuity

LAS202A Laser Safety Training for Incidental Personnel in Class 3B and Class 4 Lasers

Site-specific Training

Be escorted by Qualified Laser Operator or Authorized Personnel during laser operation.

3.1.3 General requirements for Visiting Spectator Personnel:

Be informed of the specific hazards associated with the site being visited

Be escorted by Qualified Laser Operator or Authorized Personnel during laser operation.

4.0 DEFINITIONS

4.1 General

General laser associated definitions are listed in **ANSI Std. Z136.1-2007** section 2, as well as SNL ES&H Manual Chapter 6G. In addition, the following definitions apply:

4.1.1 Personnel

Laboratory Owner: A Qualified Laser Operator having ES&H ownership of the laser facility or laser operation.

Owning Department Manager: The manager of the department having ES&H ownership of the laser system.

Qualified Laser Operators: Persons who work routinely in laser environments and energize, align, or maintain lasers, and have fulfilled the requirements specified in section 3.1.1.

Authorized Personnel: Persons who have the approval of the owning department manager or the designated DLSO to enter or work in an area when lasers are in operation. These persons shall have fulfilled the requirements specified in section 3.1.2.

Qualified Service Personnel: Representatives of the laser manufacturer or SNL employees instructed in laser service procedures by the manufacturer, or an SNL employee who has read and understood the service manual and is performing a service procedure outlined in the manual.

Incidental Personnel: All other persons (e.g. custodial staff, clerical staff or visitors) whose work makes it possible (but unlikely) that they will be exposed to laser energies or powers above the Maximum Permissible Exposure (MPE) sufficient to damage their eyes or skin. These persons shall have fulfilled the requirements specified in section 3.1.

4.1.2 Operating Procedure (OP)

The Operating Procedure is a document prepared in accordance with the requirements of **GN470001, Generic ES&H Standard Operating Procedure, A Guide to Writing Operating Procedures.** A sample OP is presented in Appendix B of this ES&H SOP. The OP shall detail site-specific hazards associated with a given laser system or operation, as well as hazard abatement/mitigation procedures and controls. The OP shall contain a list of the qualified laser operators.

5.0 HAZARDS IDENTIFICATION

5.1 Hazards

Class 3B and Class 4 laser systems present significant ocular hazards to laser operators and other personnel present in the area of laser use. Class 3B lasers may be hazardous under direct and specular reflection viewing conditions but typically do not represent a diffuse reflection-viewing hazard. A Class 3B laser is not a fire hazard. Class 4 laser systems present significant hazards to eye and skin from the direct beam and sometimes from diffuse reflections. Class 4 lasers also represent potential fire hazards. Collateral hazards associated with laser use may

include high voltage, high pressure or vacuum, flammable liquid and toxic chemical, extreme temperature, and radiation hazards.

5.1.1 Specific Hazards

As outlined in Appendix B, the site-specific OP shall include a section detailing all hazards of that laser system or operation.

5.2 Hazard Abatement/Mitigation

Laser hazard (ocular and skin) abatement/mitigation is accomplished by strict compliance with the provisions of the **ES&H Manual**, **ANSI Std. Z136.1-2007, ANSI Std. Z136.6-2007** (for outdoor laser operations) the ES&H SOP and the site specific OP and the manufacturer's operation manual. Collateral hazards shall be abated in accordance with the site specific OP, as well as the ES&H Manual.

Engineering control measures should be given primary consideration in instituting a control measure program for limiting access to laser radiation. If engineering controls are impractical or inadequate, administrative and procedural controls, and personnel protective equipment shall be used. If, the mitigation requirements specified in 5.2.1 and 5.2.2 through 5.2.4 of this ES&H SOP are inappropriate and not feasible for a specific laser system or operation, then one of the alternative procedures outlined in **ANSI Std. Z136.1-2007** shall be used. Under such circumstances, the reasons and alternatives shall be documented in the site specific OP.

5.2.1 Engineering Controls for Hazard Abatement/ Mitigation

5.2.1.1 Mandatory Requirements

(a) Access control shall be employed on every functioning door to laboratories or rooms where Class 3B and Class 4 Laser Systems are operated in accordance with section 4.3.10 of **ANSI Std. Z136.1-2007.** Class 4 lasers shall be interlocked to the access control interlock system. The access control interlock system shall be tested annually to verify functionality and documented in the laboratory notebook. The site-specific implementation of such controls shall be detailed in the site specific OP.

5.2.1.2 Recommended Strategies

The following hazard abatement/mitigation strategies are strongly recommended and should be adopted.

(a) Minimize laser hazard zone(s), where feasible, by use of enclosures, opaque curtains, or portable walls.

(b) Use beam tubes to enclose laser beams where such use does not interfere with beam access for measurements, adjustments, or intended interactions.

(c) Use beam shields/stops to prevent beams from leaving optical tables (minimum standard when 5.2.1.2(a) cannot be implemented).

5.2.2 Administrative and Procedural Controls for Hazard Abatement/Mitigation

5.2.2.1 Mandatory Requirements

(a) Class 3B and Class 4 laser work-sites shall be maintained as controlled access areas during laser operation in accordance with section 4.3.10 of **ANSI Std. Z136.1-2007.** Access shall be limited to Authorized Personnel defined in section 4.1.1 of this ES&H SOP.

(b) The Nominal Hazard Zone shall be defined in the site specific OP. Typically, the Nominal Hazard Zone (NHZ) is the entire controlled access area.

(c) The entrances to the NHZ shall be posted for the highest laser hazard Class present.

(d) Maintain laser pointing such that the laser beam cannot exit the controlled access area.

(e) Under no circumstance, shall personnel view directly (intrabeam) a Class 3B or Class 4-laser beam without protective eyewear in accordance with **ANSI Std. Z136.1-2007.**

(f) When diffuse reflections from Class 3B and Class 4 laser systems exceed the applicable maximum permissible exposure (MPE) as defined in **ANSI Std. Z136.1-2007** protective eyewear for direct viewing of such reflections shall be worn.

(g) Personnel shall avoid actions, which unnecessarily increase the risk of exposure to hazards, such as putting their eyes at the level of the laser beams.

(h) Laser beams shall not be propagated across uncontrolled walkways.

(i) Never intentionally direct the laser beam toward self or coworkers.

(j) Laser activation **should** be announced prior to activation of Class 3B and **shall** be announced prior to activation of Class 4 lasers. Such announcement shall be made to all personnel in the nominal hazard zone of the laser in operation.

(k) When optical elements are added to the beam train, add one element at a time, such that both the transmitted beam and any reflected or scattered beams from the optical element are properly controlled and appropriately terminated (beam blocks, beam stops, detectors, energy/power heads) in order to minimize the beam hazards present to personnel in the NHZ.

(l) Class 4 lasers that will be in an extended (greater than 6 months) inactive period should be posted (see example in appendix) as inactive, with owner's name, telephone number, and a requirement for a safety review prior to reactivation.

(m) All major alignments shall be performed at the minimum possible laser power necessary to accomplish the task.

(n) No incidental personnel shall be allowed in the Nominal Hazard Zone during major alignment procedures.

5.2.2.2 Recommended Strategies

(a) Maintain laser beam height such that it does not pose an eye hazard to standing workers. Seating areas must be protected from exposure by shielding against hazardous scattered radiation and inadvertently reflected or redirected beams.

(b) When workers need to bend or stoop, to below the optical table level, care will be taken to turn the head and eyes away from the table, or to otherwise shield the eyes from potential laser scatter at the standard beam height.

(c) Whenever possible, alignment procedures should be performed by one person so that unanticipated actions do not pose a hazard.

5.2.3 General Personal Protective Equipment

Laser safety eyewear shall be available to all personnel who are allowed to enter the Nominal Hazard Zone while Class 3B and Class 4 lasers are in operation. Use of other personal protective equipment for collateral hazards shall be in accordance with SNL ES&H Manual and shall be described in the site specific OP.

Laser safety goggles and spectacles shall be selected in accordance with **ANSI Std. Z136.1-2007** section 4.6.2. Of primary concern will be the laser wavelength, possible exposure level, optical density, visible transmission, and peripheral vision requirements. Specific details of such laser eyewear shall be described in the site specific OP.

Because of the broad spectral coverage of some Class 3B and Class 4 laser systems in the visible region of the spectrum, laser eyewear that provides both adequate vision and protection may not be available. If intrabeam exposure is possible and appropriate eyewear is feasible, then eyewear shall be worn. In cases where eyewear is not feasible (where protection against all wavelengths produces eyewear that is opaque throughout the visible spectrum), strict procedural or engineering controls must be rigorously enforced to avoid potentially hazardous exposures. These controls are to be detailed in the site specific OP.

5.2.3.1 Mandatory Requirements

(a) Laser eyewear specifically designed for use with infrared ($\lambda > 700$ nm) or ultraviolet ($\lambda < 400$ nm) outputs from Class 3B and Class 4 lasers shall be worn whenever there is a possibility of exposure to unconfined invisible beams.

(b) Laser eyewear shall have adequate visible transmission, to allow the user to safely perform their tasks. In operations where sufficient visible transmission is not possible, strict procedural controls must be rigorously enforced to avoid exposure. These controls are to be detailed in the site specific OP.

(c) Laser safety eyewear shall have side shields.

(d) Laser safety eyewear used in alignment procedures (visible lasers) will have an OD, which will attenuate the laser beam so as to present no greater than a Class 2 laser hazard.

5.2.3.2 Recommended Strategies

(a) Laser eyewear should be located in proximity to the entrance to the controlled area.

(b) In operations where only a single visible wavelength is in use, eye protection sufficient to afford at least blink response- Class 2 hazard protection (as defined in **ANSI Std. Z136.1-2007**) should be worn (subject to section 5.2.3.1 (b) of this ES&H SOP).

5.2.4 Electrical Hazards Associated with Laser Maintenance and Repair

5.2.4.1 Site-specific operating procedures in accordance with Electrical Safety Manual shall be used to document specific control measures used to mitigate electrical hazards present during maintenance, trouble shooting or repair of lasers.

5.2.4.2 Servicing of laser(s) and their associated power supplies shall be performed only by qualified service personnel as defined in site specific OP.

5.2.4.3 The "buddy system" (a second person nearby to provide immediate assistance, if necessary) shall be used when working with hazardous voltage - exceeding 300 volts to ground or 600 volts between electrodes, or exceeding 50 volts and having stored energy in excess of 10 Joules, or a voltage that will permit a current in excess of 10 ma-AC or 60 ma-DC through a 500 ohm load.

5.2.4.4 A lone person shall NOT perform maintenance procedures where a dangerous or lethal hazard exists. Two knowledgeable persons shall be present, one of who is clear of the hazard.

5.2.4.5 Whenever possible, “hot” trouble shooting in presence of hazardous voltages should be avoided. Hot trouble shooting requires the presence of at least two knowledgeable persons and approval of the supervisor (see ES&H Manual, Chapter 4B).

5.2.4.6 A complete set of up-to-date drawings, including schematics, should be available to the maintenance persons prior to any trouble shooting activity. Using a hazard identification list is recommended.

5.2.4.7 The site-specific operating procedure shall include those steps necessary to de-energize all hazardous voltage sources and provide a positive means of ensuring that the voltage will stay off during maintenance or repair operations. If someone else can inadvertently reactivate a de-energized circuit, then the circuit should be locked and tagged out. When LOTO is appropriate and employed, be sure to achieve a zero energy state. Use Lockout/Tagout procedures, GN470037, linked in the on-line ES&H Manual, Capter 4C.

6.0 EQUIPMENT AND MATERIALS

6.1 Equipment

Specific components of Class 3B and Class 4 Laser Systems shall be listed in the site or system OP.

Class 3B and Class 4 lasers are inventoried annually. Laser inventory can be accessed at:

\\Dropzone\public\Laser_Inventory

6.2 Materials

Collateral hazards associated with the use of Class 3B and Class 4 laser systems may include flammable, toxic, or carcinogenic materials. These materials shall be used in compliance with SNL ES&H requirements. The handling of these chemicals and materials will be in accordance with an Activity Specific ES&H Standard Operating Procedure or a site-specific Chemical Handling OP. Ensure chemical handling OP(s) are coordinated through the directorate ES&H Coordinator. In general, a Material Safety Data Sheet, MSDS, will be maintained for all chemical materials used in this activity at the site of use. Labeling, handling, storage and disposal of these materials shall be in accordance with the SNL policy in the **ES&H Manual** (**MN471001**). Detailed procedures regarding the use of chemical materials in specific laser operations shall be described in the **site-specific OP.**

7.0 STANDARD OPERATING PROCEDURE

The operating procedure for a specific laser operation shall be described in the site-specific OP. Operating procedures common to all Class 3B and Class 4 Laser Systems are included in this section.

7.1 Prerequisites and Initial Conditions

(a) Activate the access control mechanism (engineering or procedural).

(b) Ensure that all personnel in the Nominal Hazard Zone wear appropriate eyewear.

(c) Laser activation should be announced prior to energizing Class 3B lasers and shall be announced prior to energizing Class 4 lasers.

7.2 Procedures

The site specific OP shall contain the detailed operating instructions for a given laser system or laser operation. These instructions should be in accordance with the **ES&H Manual**, **ANSI Std. Z136.1-2007**, and the **manufacturer's operating procedure** and instructions.

Alignments

(a) Beam alignments shall be performed at the lowest laser output radiance necessary to perform the intended task.

(b) Unless the emitted **visible** CW beam is known be less than one milliwatt, Class 2 Allowable Emission Limit (AEL), "**Alignment" laser safety eyewear** (with an Optical Density that protects to the Class 2 Laser Hazard Level – OD_{min} that is based on a 0.25 second exposure) **shall be worn by the aligner**. Alignments involving pulsed visible sources, with outputs greater than the Class 2 AEL shall require the use of "alignment" laser safety eyewear by the aligner.

(c) Invisible radiant outputs greater than the Class 1 AEL require the use of laser safety eyewear OD_{min} to provide for Full Protection.

(d) All personnel in the NHZ, except the aligner, shall wear "Full Protection" laser safety eyewear (rated for the maximum output of the laser).

(e) Minimize the number of personnel in the NHZ during the alignment process.

(f) Place optical elements in the beam path one-at-a-time.

(g) Control and terminate the transmitted beam.

(h) Control and terminate the reflected or scattered beams

7.2.1 Maintenance

Maintenance of the laser systems shall be performed in accordance with the manufacturer's operating procedure or instructions, and any other specific maintenance procedures outlined in the OP. In addition, annual inspections of laser safety systems and engineering controls are required. Laser safety eyewear shall be visually inspected for serviceability prior to each use.

7.3 Emergency Procedures

Emergency response procedures will be in accordance with established SNL policies and procedures.

General emergency response sources:

- Dial **911 or 844-0911** or **845-0911** from a cellular phone for: fire, explosion, toxic or flammable gas release, medical emergencies or spills that cannot be handled safely.

General post-incident actions by involved personnel

- Stop activity.
- Secure the scene to prevent further injury or damage.
- Evacuate if necessary.
- Do not disturb the scene.
- Notify your Department Manager.
- Notify the Deputy Laser Safety Officer.

- Notify the ES&H Coordinator.

In addition to these general emergency response procedures, the site specific OP shall contain the names and phone numbers of the laboratory owner and responsible line management.

7.4 Postrequisites

The specific postrequisites shall be detailed in the site specific OP and shall include the following:

(a) Turn the control key to **OFF** and secure key.

(b) Laser deactivation shall be announced.

(c) Relax access control measures.

8.0 WASTE DISPOSAL

8.1 GENERAL

Waste disposal shall be in accordance with the SNL policy in the **ES&H Manual**, MN471001.

In general, ordering only those quantities of chemicals, gases, etc. that are needed to perform the operation will minimizes waste. Maintain chemical identity and control throughout its use cycle. Substituting non-hazardous or less hazardous chemicals where applicable will also reduce hazardous waste.

8.1 Waste Minimization/Pollution Prevention

Waste minimization and pollution prevention will be incorporated in the planning and operation of the activity covered by this operating procedure. Waste minimization and pollution prevention includes but is not limited to:

- Ordering the minimum quantity of chemicals required to conduct an activity
- Designing waste minimization and pollution prevention into programs, processes and activities

- Substituting non-hazardous or less hazardous chemicals where applicable

8.2 Waste Disposal

Hazardous waste will be handled in accordance with Sandia's waste disposal policy. In general liquid waste shall be stored in an approved vessel, i.e. nalgene and used wipes shall be stored in a polyethylene bag. Waste shall be disposed of prior to accumulating **55 gallons**.

9.0 ES&H REPORTING AND DOCUMENTATION

9.1 Each Class 3B and Class 4 laser or laser system shall be listed. The listing is generated as a consequence of the annual laser inventory and laser safety audit directed by the SNL Laser Safety Officer. The Annual Preliminary Hazard Screening (PHS) is used to determine the location of Class 3B and 4 laser operations. Additional documentation may include the Authorized user list (section 12 of OP) or personnel training records.

9.2 A logbook containing maintenance and modification records should be kept on all complex equipment.

10.0 REFERENCES

10.1 MN471001, ES&H Manual

10.2 ANSI Std. Z136.1-2007, American National Standard for the Safe Use of Lasers.

10.3 ANSI Std. Z136.6-2005, American National Standard for the Safe Use of Laser Outdoors.

10.4 MN471004, SNL Electrical Safety Manual.

10.5 GN470000, Developing and Implementing Environment, Safety, and Health Standard Operating Procedures (ES&H SOPs) and Safe Work Permits.

10.6 GN470001, Generic ES&H Standard Operating Procedure, A Guide to Writing Operating Procedures.

11.0 APPENDICES

Appendix A provides an example of signage for inactive Class 4 lasers (for extended inactive periods).

APPENDIX B

GUIDELINES FOR PREPARATION OF A SITE-SPECIFIC OPERATING PROCEDURE FOR A CLASS 3b OR CLASS 4 LASER SYSTEM

All Class 3B and Class 4 laser systems shall have a site-specific Operating Procedure (OP). This appendix is intended to provide guidance for the preparation of a site specific OP. The site specific OP shall follow the same format as this ES&H SOP except that some sections may be deleted or referenced to this ES&H SOP as appropriate for the hazard and risk level involved.

The first page of the site specific OP shall follow the format of the ES&H SOP. The approval signature level shall be department manager. Other signatures shall include laboratory owner or author, and DLSO.

1.0 PURPOSE, SCOPE, AND OWNERSHIP

This section should closely follow the corresponding section of the ES&H SOP, but with site-specific information included. The document ownership shall be defined as the division having ES&H ownership of the laser system.

2.0 RESPONSIBILITIES

For most cases the responsibilities described in the ES&H SOP are adequate. Should additional responsibilities be required (for a specific site), they should be listed in this section of the OP.

3.0 JOB QUALIFICATIONS

For most cases the job qualifications described in the ES&H SOP are adequate. Should additional qualifications be required (such as working with the collateral hazards), they should be listed in this section of the OP.

APPENDIX B-continued

4.0 DEFINITIONS

Any terms used in the OP, which are not defined in the ES&H Standard Operation Procedure, SP471409, should be defined in this section.

5.0 HAZARD IDENTIFICATION

This section should closely follow the format of the ES&H Standard Operation Procedure, SP471409. Specific topics, which must be contained in this section, are listed below.

5.1 Hazards

This sub-section shall describe in detail all hazards (including collateral hazards) that exist for the specific laser system or operation.

5.2 Hazard Abatement/Mitigation

5.2.1 Engineering Controls for Hazard Abatement/Mitigation

This sub-section shall contain all information concerning engineering controls for the laser operation and collateral hazards, which are not already covered by the ES&H Standard Operation Procedure. The details of engineering controls for access to Class 4 laser areas must be included in this sub-section.

5.2.2 Administrative and Procedural Controls for Hazard Abatement/Mitigation

This sub-section shall contain all information concerning administrative and procedural controls for the laser operation and collateral hazards, which are not already covered by the ES&H Standard Operation Procedure, SP471409. The Nominal Hazard Zone must be defined in this sub-section.

APPENDIX B-continued

5.2.3 General Personal Protective Equipment

This sub-section shall detail information, such as the minimum Optical Density (ODmin) required for each laser and the OD of the eyewear available, with regard to the use of laser eyewear. The types of laser eyewear available and circumstances of their usage must be specified.

For situations where laser eyewear is not feasible (due to visible light transmission requirements) procedural controls for hazard abatement/mitigation should be specified in this sub-section. Use of any other personal protective equipment for abatement of collateral hazards should also appear here.

6.0 EQUIPMENT AND MATERIALS

6.1 Equipment

Specific Class 3B and Class 4 lasers (manufacturer, model number, serial number, output parameters), as well as any ancillary equipment, which present a collateral hazard, should be listed in this section.

6.2 Materials

Detailed procedures regarding the use and generation of hazardous materials in specific laser operations shall be described in this sub-section.

7.0 STANDARD OPERATING PROCEDURE

7.1 Prerequisites and Initial Conditions

Specific information regarding preparation for laser start-up (e.g. access control, eyewear, etc.) shall be included in this section.

7.2 Operations

Detailed operating procedures including procedures for conducting alignments that are not already covered by the ES&H Standard Operation Procedure,

APPENDIX B-continued

SP471409, or a reference to the manufacturer's operating manuals shall be included in this sub-section.

7.3 Postrequisites

Specific information regarding laser shutdown (i.e. access control, key control, etc.) shall be included in this section.

7.4 Maintenance

Site specific operating procedures in accordance with Electrical Safety Manual and the ES&H Manual shall be used to document specific control measures used to mitigate electrical hazards present during maintenance, trouble shooting or repair of lasers, shall be included in this subsection.

7.5 Emergency Procedures

This section shall contain all general emergency response procedures appearing under this sub-heading in the ES&H SOP, as well as the names and phone numbers of the laboratory owner and responsible line management.

8.0 WASTE DISPOSAL

For most cases the waste handling procedures described in the ES&H SOP, SP471409, are adequate. If additional procedures (such as those associated with some collateral hazards) are required, they shall be listed in this section of the OP.

9.0 ES&H REPORTING AND DOCUMENTATION

For most cases the ES&H reporting and documentation procedures described in the ES&H SOP, SP471409, are adequate. If, in very special circumstances, additional procedures are required, they shall be listed in this section of the OP.

10.0 REFERENCES

This section shall cite the ES&H SOP as well as any other references relevant to the OP.

Example:

10.1 **ANSI Std. Z136.1-2007, American National Standard for the safe use of lasers.**

10.2 **SP471409, Activity Specific ES&H Standard Operating Procedure for Class 3B and Class 4 Laser Systems Operation in Research.**

10.3 **MN471001, ES&H Manual.**

10.4 **Owner's Manual**

11.0 APPENDICES

Appendix A of the OP shall contain a list of Qualified Laser Operators. Other appendices should be included as necessary.

Title: ES&H SOP Class 3b & 4 Laser Systems Operation in Research

12.0 AUTHORIZED USERS LIST

By my signature below, I affirm that I have read and understand this ES&H SOP SP471409, and all references called out in procedural steps, and I agree to operate with the stated constraints.

Name (Printed)	Signature	Dept. /Company	Date
Name (Printed)	Signature	Dept. /Company	Date
Name (Printed)	Signature	Dept. /Company	Date
Name (Printed)	Signature	Dept. /Company	Date
Name (Printed)	Signature	Dept. /Company	Date
Name (Printed)	Signature	Dept. /Company	Date
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